

Space Weather Technical Forecast

Issued on Saturday, 25 June 2022 at 01:23 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Slight Chance of an M-class flare. Active electron fluence Likely by day 4. Slight chance of G1/Minor Storms today.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has remained Low over the past 24 hours, with only isolated low level C-class flares. There are currently three sunspots on the visible disc, with AR3038 remaining the largest and most complex. However, this region in the northwest quadrant has diminished in size and complexity, and is now classified as a Eho/beta. The other two sunspots are small and stable.

A large filament in the northwest disc was seen to lift off early on the 24 June. Lack of available imagery has hindered the analysis, as a CME may have been emitted, and any CME may have an Earth directed component. However, currently no Earth-directed CME's are expected.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR and ACE at L1, showed potential weak coronal hole-like influences, with the phi angle negative (towards the Sun) throughout. The solar wind speed was predominantly 410-450 km/s, but very briefly peaked at 542 km/s at 24/1508 UTC. The solar wind density was initially at average levels but gradually declined to end the period at below average values. The IMF started at weak levels, then from 24/1547 UTC increased to moderate levels, and peaked at 10nT at 24/1735 UTC. The Bz component was positive for the first half of the period, then became predominantly negative from 24/1515, reaching -7 nT at 24/2049 UTC. The resulting geomagnetic activity was Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) measured by GOES16 remained at Background levels through the period. High energy electron flux (greater than 2MeV) peaked at High levels, with 981 pfu observed at GOES16 at 24/1525 UTC. The corresponding 24-hour integrated electron fluence remained below the Active threshold (1e8 integrated pfu) on a fairly steady trend, with an observed fluence of 3.58e7 integrated pfu at 25/0001UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to be Low, with a daily Slight Chance of an isolated M-class flare. AR3038 dominates the disc in terms of flare risk, but will rotate off the visible disc during day 3 (27 June). No significant returning regions are expected to rotate onto the visible disc.

Solar Wind / Geomagnetic Activity: No CMEs are currently thought to be Earth directed. The combined influence of up to three negative polarity coronal holes (CH93, 94 and/or 95) may enhance, the currently slightly elevated solar wind, to elevated levels, perhaps strong levels, from later today and through days 2 and 3 (26th and 27th). Solar winds are expected to decline to slightly elevated levels through day 4 (28th).

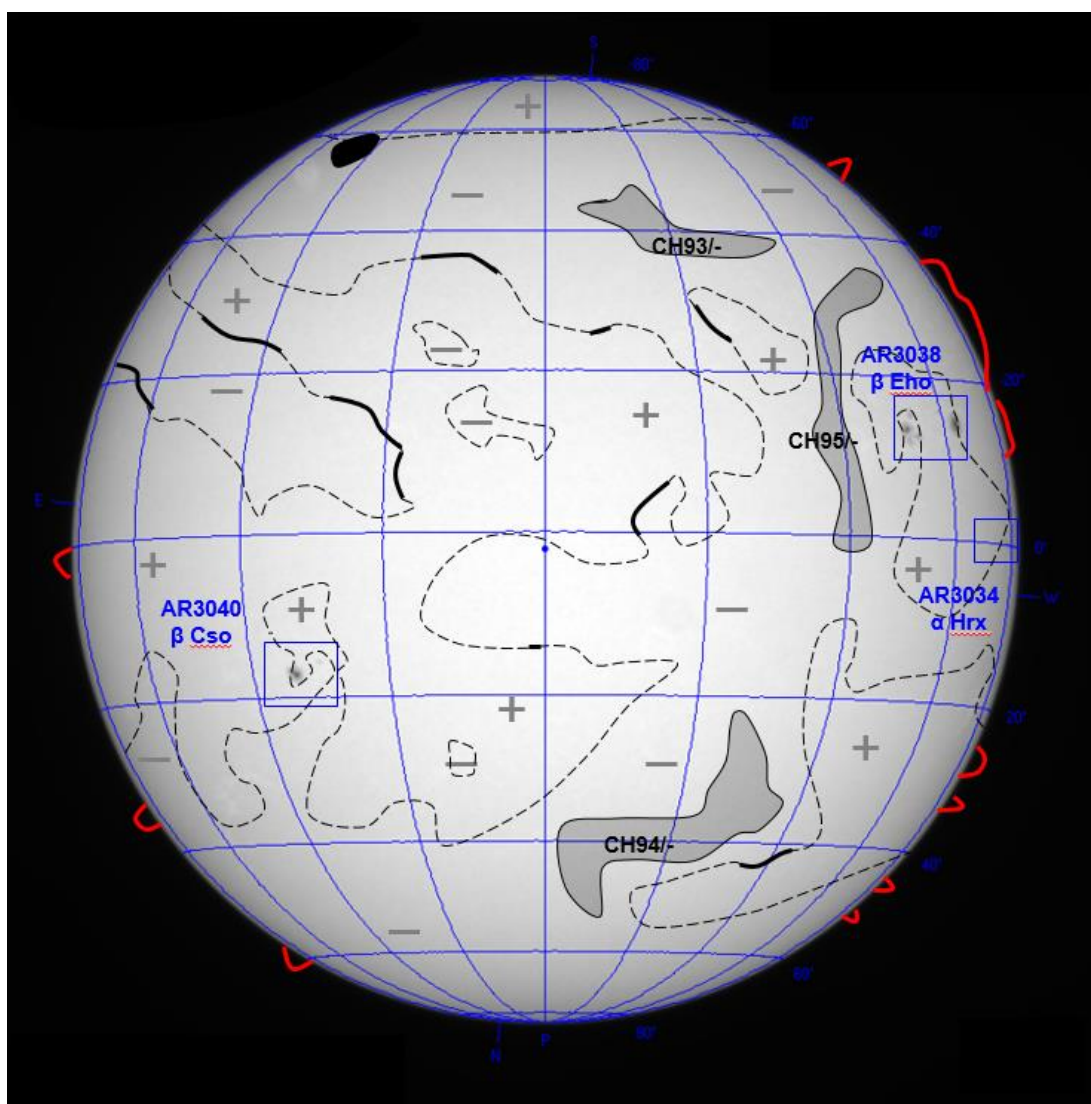
Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

There is a Slight Chance of G1/Minor Storms (Kp 5) later today and especially through tomorrow, otherwise geomagnetic activity is expected to be Quiet to Unsettled (Kp 2-3) for much of today, and also through day 4, while in-between increasing Unsettled to Active (Kp 3-4) under the influences of one or more high speed streams.

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10 MeV) is expected to be at Background levels during the period, but with a daily Slight Chance of an S1 or greater event as a result of the large region AR3038 gradually nearing the western limb. The high energy electron flux (greater than 2 MeV) should show a gradual rising trend in this period. Corresponding electron fluence is therefore expected to develop an eventual rising trend, with Active ($1e8$ integrated pfu) fluence becoming Likely from late Monday 27 June.

Figure 1. Solar Analysis Valid 24/1924 UTC.



Key: Filament ____, Prominence ____, Magnetic Field Line - - -, Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α - β - γ - δ and Zurich-McIntosh Axx etc.

Geomagnetic Storms:

No CMEs are currently expected to reach Earth, however confidence is low regarding this, due to a lack of imagery.

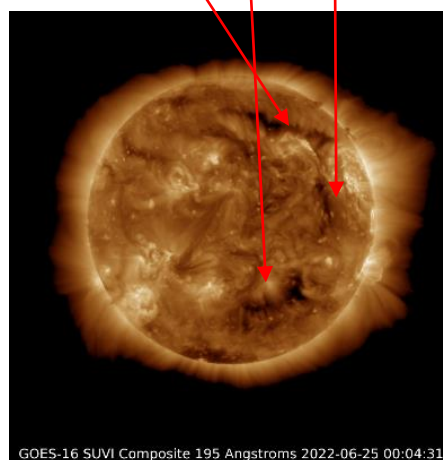
There are currently up to three negative polarity coronal holes on the disc (CH93, 94 and 95), however as they cover similar heliographic longitudes, distinguishing between them is not likely to be possible. STEREO A MAG and PLASTIC data are indicative of a reasonable size CIR at a time which would equate to an arrival time at Earth early today, after which elevated or perhaps strong wind speeds are possible. The coronal holes show little resemblance to the previous rotation, which limits the use of persistence forecasting.

There is a Slight Chance of G1/Minor Storms (Kp 5) later today and especially through tomorrow, otherwise geomagnetic activity is expected to be Quiet to Unsettled (Kp 2-3) for much of today, and also through day 4, while in-between increasing Unsettled to Active (Kp 3-4) under the influences of one or more high speed streams.

The typically muted geomagnetic response to coronal hole high speed streams near the solstice is the rationale for the relatively low probabilities of G1 in this instance.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	20	20	10	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: Latest image showing coronal holes 93, 94 and 95.



Radio Blackouts - X-Ray Flares:

Note that there remains difficulty in obtaining images for the analysis. There are currently three numbered regions on the disc. AR3038 continues to show very slight areal decay through the period, but despite this AR3038 remains the largest and most complex on the visible disc with an Eho/beta classification. The remaining two groups are stable and unremarkable.

Due to the slight decay of AR3038 the probabilities of significant flares has been reduced a little, with the region leaving the disc during day three (Monday 27 June). No significant new regions are expected to rotate onto the disc in the coming days.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	15	15	15	5
Very Active	R3 to R5 X Class	No	2	2	2	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is currently at Background levels, and will most likely remain at this level through the period, given the observed lack of activity from the main sunspot region on the disc, AR3038.

Radiation Storms	Level (cm ⁻² sr ⁻¹ s ⁻¹)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	5	5	5	2
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = cm ⁻² sr ⁻¹ s ⁻¹)						

High Energy Electrons Event (≥ 2MeV):

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

The high energy electron flux (greater than 2 MeV) should show a gradual rising trend in the four days, perhaps with some temporary suppression today due to geomagnetic activity from a potential CIR from high speed stream arrival(s) from one of up to three negative polarity high speed streams: CH93, 94 and/or CH95. The flux is expected to breach the High threshold at times from day 3 onwards.

The corresponding electron fluence is therefore expected to eventually develop a rising trend, with Active (10^8 integrated pfu) fluence becoming Likely from during day 4 (28 June). The Met Office REFM is considered to be showing reasonable guidance at present, with the fluence remaining below the Active threshold for the first three days. Persistence forecasting is unhelpful at this stage, due to the difference in coronal holes compared to the previous rotation.

GEO Electron Environment	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{day}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^8$	No	10	20	40	60
Very Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^9$	No	1	1	1	5

Figure 3: Met Office REFM model.

